A Prototype Use-Dependent Database

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Table 1. Comparison of near-surface properties between grassland and cropland for Aksarben soils. [1]

Property	Measurements		Current Database
	Grass	Cultivated	
Aggregate stability (pct) [2]	95	10	N/A
Bulk Density (g cc^{-1}) [3]	1.20	1.35	1.35 - 1.55
Organic matter (pct) [4]	6	3	2 - 4
Ksat (in hr^{-1}) [5]	0.3	0.02	0.6 - 2
Infiltration (in hr^{-1}) [6]	0.3	0.03	N/A
Structure [7]	Moderate to Strong Fine Subangular	Weak Coarse Blocky	N/A
Derivative Quantities			
Hydrologic Group [8]	B	D	B
K factor [9]	0.32	0.44	0.32
Pesticide Loss [10]			
Leaching Potential	Low	Very low	Intermediate
In Runoff	Intermediate	High	Intermediate

[1] Aksarben: Typic Argiudolls, fine, smectitic, mesic; 35-40% clay in Ap; slope 2-5%; low erosion; comparison of ≥25 years smooth bromegrass meadow and short term no-till soybean-grain sorghum with no surface-connected macropores.
[2] Method 4G1, Soil Survey Investigations Report 42.
[3] Maximum 0-20 cm.
[4] 0-20 cm.
[5] Amoozemeter--constant level borehole device. Water column 10-25 cm.
[6] Steady ponded. Small double ring device. Wetted previous day.
[7] Weakest 0-20 cm.
[8] Based on Ksat of the near surface if lower than beneath.
[9] Nomograph method using texture, organic matter, structure, and permeability.
[10] Goss and Wauchope. 1990. Proceedings of the 3rd Natural Resources Conference on Pesticides.

Introduction

The traditional soil survey database does not change with the use of the soil. Rather, it is intended to be applicable to the dominant land use of that soil in the survey area. The same data apply whether cropland or rangeland, recently clear cut forestland versus old stand, rangeland from poor to excellent condition, and for cropland from conventional tillage to no-till. Differences in soil properties, and hence behavior among uses, may be large which argues for a use-dependent database. Our purpose is to discuss a change to such a database.

Illustrative Data

Tables 1 and 2 contain measured values and values from the soil survey database for the near surface of Aksarben and Monona soils that occur in the western Cornbelt. Cultivated and grass sites are compared. Figure 1 shows the sites for the Aksarben soil. Based on the nomograph method, erosional K is higher for the cultivated sites. Measured Ksat and infiltration under grass is higher than for the cultivated sites. Both soils are assigned Hydrologic Group B. The cultivated sites might be C or D. Differences both in the Hydrologic Group and in erosional K affect the method of screening for pesticide loss used by the Natural Resources Conservation Service.

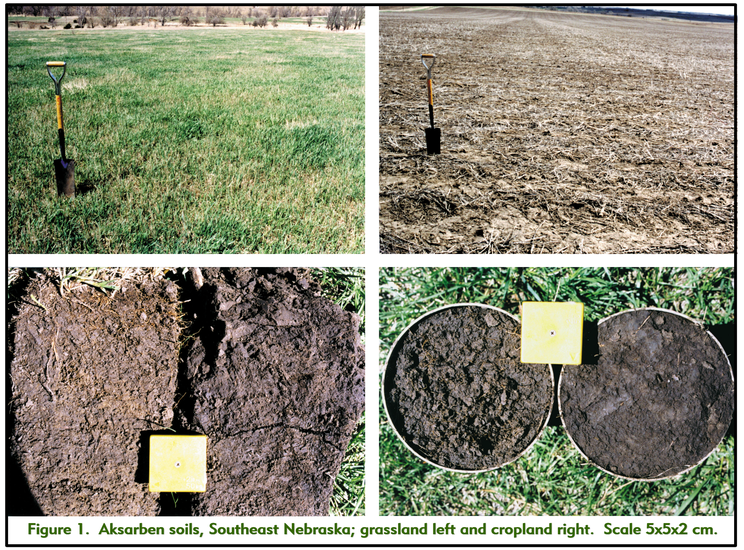

Figure 1. Aksarben soils, Southeast Nebraska; grassland left and cropland right. Scale 5x5x2 cm.

Implementation

Soil Mapping: No change would be needed.

Use Groupings: Soil uses must be grouped to make the number of alternatives manageable. Decisions would need to be made as to which land uses have values for selected soil properties that are significantly different to justify separation. It is not clear as to the extent that modeling could be used to predict use-dependent properties from use-invariant. Differences due to tillage practices might be modeled successfully. The difference between rangeland and cropland might not be subject to modeling.

Soil Data Records: The records used for soil behavior prediction would be a combination of use-dependent and use-invariant data. Decisions would be required on what are the use-dependent properties and the depth to which use-dependence extends.

NASIS: The Natural Resources Conservation Service stores and manages data associated with the National Cooperative Soil Survey in the National Soil Information System (NASIS). The database is designed to be flexible and dynamic so it can be modified as new ways of describing and documenting soils are identified. NASIS currently accommodates the separation of soils into seven primary earth cover groups such as crop cover, grass/herbaceous cover, tree cover, etc., as a means of making use-dependent separations. However, this capability has had very little use. Secondary categories are also available such as row crop, close-grown crops, hardwoods, etc. Additional categories can be added to these separations, or other levels of separation may be added. If necessary, the data model can be changed to more appropriately display the data.

Advantages

- Increase the accuracy of interpretations.
- Users would be able to select the most applicable soil property dataset.
- Implementation would of necessity bring technical soil services and soil mapping activities closer together.
- Plant scientists and agronomists become more involved in the soil survey.
- Field experimental studies are usually use-specific. Results will be more directly applicable to use-dependent databases than to use-invariant.
- Use-dependent data can be placed in classes for evaluation of soil quality.
- A use-dependent database would provide a large body of information about the state of America's land.

Summary

A use-dependent database should be feasible. It would give customers the latitude to select the dataset most applicable to their soils instead of the present obligatory database. Further, it would facilitate soil quality evaluation. Establishment of an operative use-dependent database requires much work. This poster is only an incomplete sketch of what must be a complex multifaceted undertaking.

Table 2. Comparison of near-surface properties between grassland and cropland for Monona soils. [1]

Property	Measurements		Current Database
	Grass	Cultivated	
Aggregate stability (pct) [2]	85	25	N/A
Bulk Density (g cc^{-1}) [3]	1.11	1.44	1.25 - 1.30
Organic matter (pct) [4]	3.6	2.9	2 - 4
Ksat (in hr^{-1}) [5]	0.13	0.07	0.6 - 2
Infiltration (in hr^{-1}) [6]	1.3	0.10	N/A
Structure [7]	Moderate Fine and Medium Subangular	Weak Coarse Blocky	N/A
Derivative Quantities			
Hydrologic Group [8]	B	C	B
K factor [9]	0.27	0.43	0.32
Pesticide Loss [10]			
Leaching Potential	Low	Intermediate	Low
In Runoff	Intermediate	High	Intermediate

[1] Monona: Typic Hapludolls, fine-silty, mixed, superactive mesic; 25% clay in Ap; slope 2-5%; low erosion, comparison of 10 years smooth bromegrass in the Conservation Reserve Program and corn-soybean under recent no-till with no surface-connected macropores.
[2] Method 4G1, Soil Survey Investigations Report 42.
[3] Maximum 0-20 cm.
[4] 0-20 cm.
[5] Amoozemeter--constant level borehole device. Water column 10-25 cm.
[6] Steady ponded. Small double ring device. Wetted previous day.
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